**Metamorphic Rocks!** Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_

 Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_

 Hour \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Day 1**

**Background**

 When you make a snowball, snow goes through many changes. As you press down, most of the air gets squeezed out of the snow. As the snowflakes are squeezed into a smaller space, the snow becomes more dense. Heat from your hand also causes the snow to change. Some of the snowflakes recrystallize. If you work hard enough, the pressure and heat from your hands transform the snow into an icy ball. In a similar way, heat, pressure, and hot chemical fluids inside the Earth can change any kind of rock into metamorphic rock.

 In this activity students will model how rocks respond to heat and pressure within the Earth. The experiment uses the clay models of rock layers as a model for what happens to rocks when subjected to heat from magma, lava or burial within the Earth.

**Materials**

**-**dental floss/plastic knife -clay

-ruler -waxed paper (optional)

-tray -book

-hot plate (teacher) -soapy water (teacher)

-mug

**Procedure**

1. Make sure you have the above materials.
2. Divide your clay into three pieces flatten the

 pieces into rectangular pieces and stack them

 on top of one another. (see picture 1)

1. Slice a piece of your clay model off (using the

floss by working it back and forth with a sawing

motion and pressing down). Make one end slope

downward. (see picture 2)

1. Raise your hand when you are ready for hot water. The hot water represents hot lava pouring down the side of a mountain. Make sure your slice of your clay model that is sloped downward is in your tray. Carefully pour the water over the top of the clay. Record what you observed in the Observations Day 1 section attached.
2. With the remaining part of your clay model. Measure the length, width, and height of your model in cm. Record in the Observations Day 1 section attached.
3. Place a piece of wax paper on top of your clay model and press a textbook on top of your model as hard as you can.
4. Measure the length, width, and height of your model (cm) in the Observations section attached.
5. Answer questions 1-5 using complete sentences with a restate.

**Observations Day 1 (Steps 1-5)**

|  |
| --- |
| Illustrate the slice of clay after your poured water belowDescribe what happened to your slice of clay after you poured the water on it below.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

**Observations Day 1 (Steps 6-8)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Time** | **Length (cm)** | **Width (cm)** | **Height (cm)** |
| **Before pressure is** **applied** |  |  |  |
| **After pressure is** **applied** |  |  |  |
| **Change**  |  |  |  |

**Day 1 Lab Questions (orange 99-102)**

1. Compare and contrast our model of metamorphic rock to how metamorphic rocks act in nature.

2. Describe how metamorphic rocks are formed.

3. What do metamorphic rocks start out as?

4. Would we have had different outcomes if the hot soapy water and the pressure from the book was applied at the same time? Explain your answer.

5. Describe three different kinds of metamorphic rock and their uses.

**Day 2**

 The crust and upper mantle of the Earth is broken up into tectonic plates. Tectonic plates are always moving, although at a slow pace they move about 5-10 cm per year. When the tectonic plates move they shift the land above them. Tectonic plate movement can create landforms such as faults, mountains and volcanoes to name a few. When these landforms are created the rock that is associated with them is changed. We will model how metamorphic rock can change when volcanoes or mountains are formed.

**Materials**

-three small balls of clay

**Procedure**

1. Flatten your clay into three rectangular

 pieces and stack them on top of one another.

2. Measure the height, length and width of your clay model. Record your data in the Data Table Day 2.

3. Push the outer sides of your model together

 as if a mountain or volcano is being formed

 by your model. (See picture 3)

4. Measure your height, length and width of your clay model. Record your data in the Data Table Day 2

5. Draw your observations in the Observations Day 2 section.

**Data Table Day 2**

|  |  |  |  |
| --- | --- | --- | --- |
| **Time** | **Length (cm)** | **Width (cm)** | **Height (cm)** |
| **Before pressure is** **applied** |  |  |  |
| **After pressure is** **applied** |  |  |  |
| **Change**  |  |  |  |

**Observations Day 2**

|  |
| --- |
| Draw what your model looked like after you pushed the sides in. |

As rock is heated and put under pressure, its texture and its composition can change. First, mineral grains get compacted and the rock gets more dense. The clay minerals in the rock begin to line up giving the rock a foliated texture. Minerals can also recrystallize. When this happens, they grow larger without changing in composition. Sometimes new minerals form. The types of minerals that form leave clues to how deeply the rock was buried and how hot it was. We will examine several pictures of metamorphic rock and examine the minerals in the rock to better understand foliated and nonfoliated metamorphic rock. Closely examine the metamorphic rock pictures and answer the following questions.

6. Define foliated metamorphic rock.

7. Define nonfoliated metamorphic rock.

8. Which rocks have foliated minerals and how can you tell?

Sketch the minerals below

9. Which rocks have nonfoliated minerals and how can you tell?

Sketch the minerals below

10. Describe two examples of foliated metamorphic rock and their uses.

11. Describe two examples of nonfoliated metamorphic rock and their uses.